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Students' Visual Thinking Ability With Cognitive Style *Visualizer-Verbalizer* Through The CTL Learning Model For Class VIII MTsN 4 Tulungagung

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ABSTRACT :
This research was motivated by students who still find it difficult when applying a problem in visual form. The related cognitive style is visualizer-verbalizer. One way to upgrade students' visual thinking skills is by applying the CTL learning model. The point of this research is to: 1) Find out the effect of using the CTL learning model on students' visual thinking abilities. 2) Describe students' visual thinking abilities using the visualizer and verbalizer cognitive styles. This research method is a mixed method type of sequential explanatory design. Quantitative data collection techniques use tests, while prerequisite test data analysis uses homogeneity, normality, and independent samples t-test. Qualitative data collection techniques use questionnaires, tests and interviews, while data analysis techniques use Creswell's steps. The research results show: 1) There is an influence of the CTL learning model on students' visual thinking abilities of 100%. 2) The visual thinking ability of students with the visualizer cognitive style is able to achieve all indicators of visual thinking ability, namely looking, seeing, imagining, showing & telling, while students with the verbalizer cognitive style are able to achieve 3 indicators of visual thinking ability, namely looking, seeing, showing & telling.

Key words: *Visual Thinking Ability; CTL; Visualizer-Verbalizer.*

INTRODUCTION

Instruction is the foremost critical thing in human life (Nasrah & Elihami, 2021). One field of study that has an vital part within the world of education is mathematics. One field of think about that has an imperative part within the world of instruction is mathematics. One capacity that has an vital part in learning arithmetic is visualization. Visualization is iconic (without words it shows meaning) (Kusuma et al., 2020). Visualization is closely related to students' visual thinking abilities (Wahyuni et al., 2022).

Visual thinking is the process of formulating and connecting ideas to obtain new patterns. The stages of the visual thinking process according to Bolton are the looking, seeing, imagining, showing and telling stages. The looking stage means students are able to identify problems through viewing and reading activities and gathering information on a problem. The seeing stage means students are competent to understand and understand the correlation midst what is known and what is inquired about by selecting and grouping activities and planning problem solving in a problem. In the imagining stage, students are able to set a pattern through the activity of describing problems and writing problem-solving solutions to a problem. The

showing and telling stage means students are competent to describe what was obtained from the problem and present the results (Bolton, 2011). Visual thinking can also be interpreted as a process for understanding and interpreting existing ideas to find new visual forms (Aini & Hasanah, 2019). Visual thinking is the ability to change over all sorts of data into pictures, illustrations, or other shapes that can offer assistance communicate data (Sholihah et al., 2019). Therefore, visual thinking is an alternative to create it simpler for students to understand mathematics material.

Based on data obtained by researchers in the field during pre-observations that were carried out at MTs Negeri 4 Tulungagung, it showed that symptoms were found in students that pointed to the state of students' visual thinking abilities. The results of the problem solving test show that students still find it difficult when applying a flat-sided geometric problem into visual form. This is in line with (Ariawan, 2017) who also states that students experience difficulties in the subject of geometry because their visual thinking skills are not yet perfect. Visual thinking abilities between men and women are different, where male students are more able to process images well than female students (Yogi et al., 2021). So visual thinking plays an imperative part within the victory of learning geometry since understudies who learn without utilizing visual considering aptitudes are inclined to encountering misguided judgments (Sumarni & Prayitno, 2016).

Students' visual thinking abilities can be improved by optimizing the role of the teacher. Teachers responsible for making it happen meaningful mathematics learning and strengthening students' skills, one of which is applying appropriate learning models according to the obstacles and difficulties experienced by students (Asikin et al., 2021). One effective learning model that can be used is mathematics learning, namely Contextual Teaching and Learning (CTL) (Sari et al., 2018).

The CTL learning model is a instructing and education concept that makes a difference instructors connect the fabric instructed in lesson with students' real-world circumstances (Wandini & Banurea, 2019). The CTL earning demonstrate looks for to empower understudies to investigate their capacities by considering concepts whereas applying them to the genuine world around students (Taufik, 2019). The CTL learning process includes seven primary components, to be specific: Constructivism, inquiry, questioning, learning community, modeling, reflection, authentic assessment (Anggreni et al, 2020).

One of the mathematical materials that is broadly utilized in living is geometry. Flat-sided space shapes are a part of geometry (Suprayo et al., 2023). There are lots of flat-sided shapes ranging from the simplest such as cubes, blocks, pyramids to very complex ones such as multi-

sided pyramids or shapes that resemble crystals. These buildings can be calculated from their surface area to their volume so that the final results can be used in everyday life (Kementerian Pendidikan dan Kebudayaan, 2017).

One of the recommended solutions to solve the problem above is to actualize the CTL learning demonstrate to make strides students' visual thinking abilities. Previous research conducted by (Aruan et al., 2022) attempted to implement the CTL learning model towards understanding mathematics concepts for class VIII junior high school students, apart from that (Asrizal et al., 2018) also implemented the CTL learning model to improve information, demeanors and competencies logical handle abilities of course VIII students.

Each student has different visual thinking abilities in learning mathematics. This is often caused by the way understudies get and handle the data they get is diverse, which is called cognitive style (Mulyo et al., 2019). Cognitive style could be a student's way of preparing, getting and handling data. Thoughts in arithmetic are frequently passed on within the frame of visual images and verbal images. The cognitive styles connected to contrasts in getting data outwardly and verbally are the visualizer and verbalizer cognitive styles (Amilia & Rahaju, 2022). People with a visualizer cognitive fashion learn superior when they get visual data such as pictures, charts and maps, while individuals with a verbalizer cognitive style learn superior when they can peruse information, learn superior when they can peruse information in text or written form (Habibi et al., 2020).

Based on the depiction over, it is vital to apply the CTL learning demonstrate to progress students' visual thinking abilities and continue research on students' visual thinking abilities in terms of the visualizer-verbalizer cognitive style. Therefore, This research was conducted to determine the impact of applying CTL on students' visual thinking abilities and to describe students' visual thinking abilities based on the visualizer-verbalizer cognitive style.

Methods

This research was located at MTs Negeri 4 Tulungagung. The time for carrying out the test is in the even semester of the 2023/2024 academic year with flat-sided building material. Instrument validation was carried out by supervisor lecturers and validator lecturers. This type of research is combination research or mixed methods. This collaborative research design uses the Sequential Explanatory Design model which is carried out by collecting data and analyzing quantitative data in the first stage and followed by data collection and qualitative data analysis in the second stage.

Quantitative research uses a posttest only control design, meaning the author will use two groups of subjects, namely the control class and the experimental class. The populace in this

think about was class class VIII students at MTs Negeri 4 Tulungagung. Meanwhile, the samples were classes VIII-C and VIII-D MTs Negeri 4 Tulungagung with 32 students in each class, with subjects set using a purposive sampling technique. Data collection techniques in quantitative research begin by providing treatment by applying the CTL learning model in the experimental class, while for the control class by using the conventional learning model (lecture). Next, give a post-test to the experimental and control groups to determine the effects and results resulting from the treatment given. The type of questions used for this posttest is an essay type of questions with 2 items. Quantitative research data analysis techniques use prerequisite tests, namely homogeneity, normality and hypothesis tests. The homogeneity test and normality test were carried out with the help of SPSS Statistics 19 for Windows with the criteria of a value of $p > 0.05$, then the distribution was declared normal and homogeneous, whereas if $p \leq 0{,}05$ then the distribution was declared abnormal and not homogeneous. Meanwhile, to test the hypothesis using the independent samples t-test and effect size test with the basis for decision making as follows: a). If the value $(\mathrm{Sig.}) \leq 0.05$ then H_0 is rejected, b) If the value $(\mathrm{Sig.}) > 0.05$ then H_0 is accepted. The hypothesis tested reads as follows: a) H_0: There is no effect of CTL on students' visual thinking abilities. b) H_1: There is an influence of CTL on students' visual thinking ability.

Data collection techniques in qualitative research begin with administering a questionnaire with the aim of obtaining data in the form of classifying students' cognitive styles, namely visualizers and verbalizers. This questionnaire was given to 32 students in class VIII-D MTs Negeri 4 Tulungagung as heterogeneous research subjects. The indicators used in the cognitive style questionnaire are guided by Andrew L. Mendelson's Visualizer and Verbalizer Questionnaire (VVQ). Next, they gave a test to students to see their visual thinking abilities, followed by interviews with 4 research subjects with details of 2 subjects who had a visualizer cognitive style and 2 subjects with a verbalizer cognitive style. Data analysis techniques in qualitative research use the data analysis model from Creswell. Meanwhile, checking validity is carried out through several methods, namely diligent observation, technical triangulation and discussion with colleagues.

Result

The results of this research are separated into two, namely quantitative research and qualitative research. Quantitative research is to see the affect of executing the CTL learning model on students' visual thinking abilities, while qualitative research is to describe students' visual thinking abilities based on their visualizer-verbalizer cognitive style.Based on the results of quantitative research conducted through visual thinking ability tests on experimental class

students using the CTL learning model and control classes using the conventional lecture learning model, the results obtained are listed in Table 1.

Table 1. Results of Students' Visual Thinking Ability Test

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Eksperimen	32	81.00	3.810	.674
	Control	32	49.13	5.488	.970

Based on Table 1, the average value of visual thinking ability of experimental class students is 81.00, while the average value of visual thinking ability of control class students is 49.13. This can prove that the average visual thinking ability score for the experimental class is higher than the control class. Therefore, it can be stated that the implementation of the CTL learning model produces students' visual thinking abilities that are better than the conventional lecture learning model. Next, proceed with hypothesis testing. However, before that, the researchers first carried out prerequisite tests for homogeneity and normality, with the results listed in Tables 2 and 3.

Table 2. Homogeneity Test Results

Test of Homogeneity of Variances

Hasil Belajar Matematika

Levene Statistic	df1	df2	Sig.
2.196	1	62	.143

Based on Table 2, a significance value of 0.143 is obtained, so it can be concluded that the two groups of data are homogeneous.

Table 3. Normality Test Result

Tests of Normality

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning outcomes	Control	.128	32	.197	.958	32	.241
	Eksperiment	.131	32	.179	.962	32	.317

a. Lilliefors Significance Correction

Based on Table 3, it can be seen from the output that the sig value is obtained. from Kolmogorov-Smirnov and Shapiro Wilk for the experimental class and control class is greater than 0.05, then all group data is normally distributed. Because the data is homogeneous and normally distributed, it is proceeded with the Independent Sample T-Test hypothesis test with the results listed in Table 4.

Table 4. Hypothesis Test Results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	2.196	.143	26.991	62	.000	31.875	1.181	29.514	34.236

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	2.196	.143	26.991	62	.000	31.875	1.181	29.514	34.236
	Equal variances not assumed			26.991	55.252	.000	31.875	1.181	29.509	34.241

Based on table 4 above, a two-tailed significance value of 0.00 is obtained, meaning that the hypothesis which states "there's an impact of the CTL learning model on students' visual thinking abilities" is accepted. Then proceed with the effect size test of Cohen's formula to find out how much influence the Contextual Teaching and Learning (CTL) learning model has on students' visual thinking abilities, with the following results.

$$S_{polled} = 4.65$$

$$d = \frac{x_t - x_c}{S_{polled}} = 6{,}85$$

Based on the effect size test according to Cohen's criteria, if d=6.85 then the percentage of influence is 100%, which means it has a high effect. This implies that there's a big influence using the CTL learning model in improving students' visual thinking abilities. Based on the results of qualitative research, the cognitive styles of students in class VIII-D were obtained with the following explanation:

Table 5. Cognitive Style Questionnaire Results

Visualizer	*Verbalizer*	*Negligible*
2 students	2 students	28 students

Next, all subjects were given test questions in the form of essay and 4 students were taken as subjects with details of 2 students with visualizer cognitive style and 2 students with verbalizer cognitive style. The following are the results of working on the visualizer cognitive style subject.

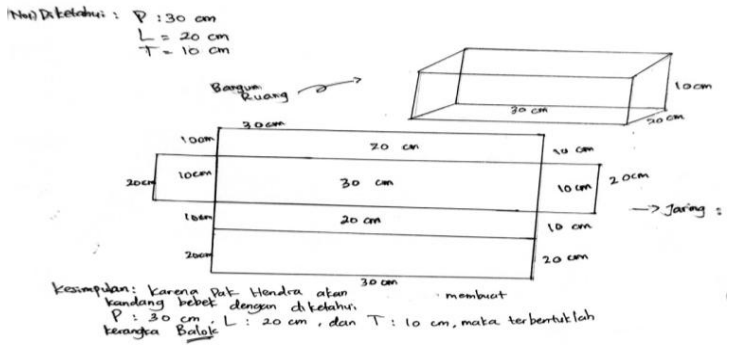

Figure 1. Results of the work of subject 1 cognitive style visualizer question number 1

Based on Figure 1. at the looking stage the subject is capable to write down what is known in the question. In the seeing stage, the subject does not write down what is asked in the question, but he is able to explain it during the interview process. The imagining stage is able to draw the shape of the flat side of the block with dimensions of 30cm long, 20cm wide and 10cm high. The subject also made nets from blocks including the dimensions, although the dimensions written on one of the beam ribs were not precise, but he was able to explain during the interview process. The showing and telling stage is able to write conclusions from solving the problems that have been worked on.

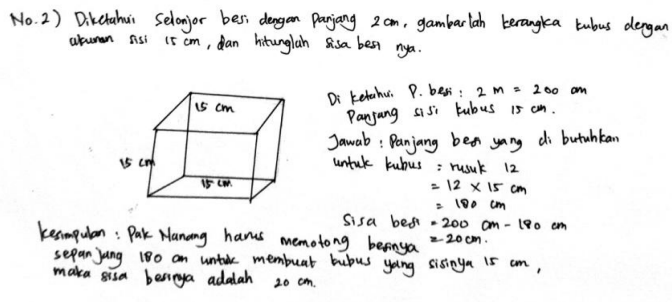

Figure 2. Results of the work of subject 1 cognitive style visualizer question number 2

Based on Figure 2. at the looking stage the subject is capable to write down what is known in the question. In the seeing stage, the subject is capable to compose down what is inquired in the question. The imagining stage is able to draw the shape of the flat side of the cube with an edge length of 15 cm. The showing and telling stage was able to write conclusions from solving the questions that had been worked on, but even though he did not write down the steps for solving the problems carried out in accordance with instructions, he was able to explain them during the interview process.

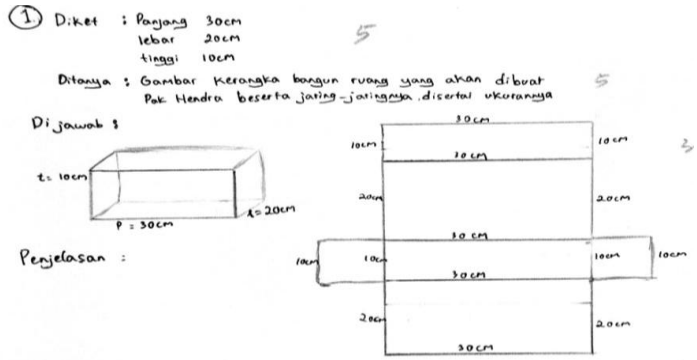

Figure 3. Results of the work of subject 2 cognitive style visualizer question number 1

Based on Figure 3. at the looking stage the subject was able to solve question number 1 by writing what was known in the question. In the seeing stage, the subject is capable to compose down what is inquired in the question. The imagining stage is able to draw the shape of the flat side of the block with dimensions of 30cm long, 20cm wide and 10cm high as well as making a net from the blocks with their dimensions. The showing and telling stage does not write conclusions from solving the questions that have been worked on but is able to explain during the interview process.

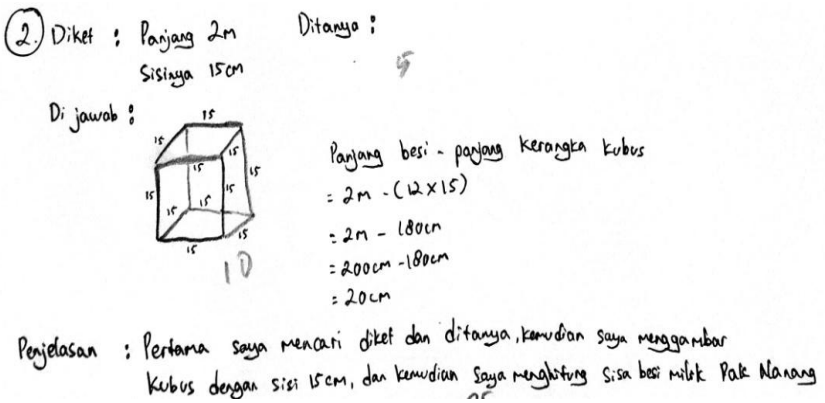

Figure 4. Results of the work of subject 2 cognitive style visualizer question number 2

Based on Figure 4. at the looking stage the subject was able to solve question number 2 by writing what was known in the question. At the seeing stage, the subject did not compose down what is inquired, but when questioned amid the inteview, process he was able to explain it. The imagining stage is drawing the flat side of the cube with an edge length of 15 cm. The showing and telling stage is able to write down the completion steps taken.

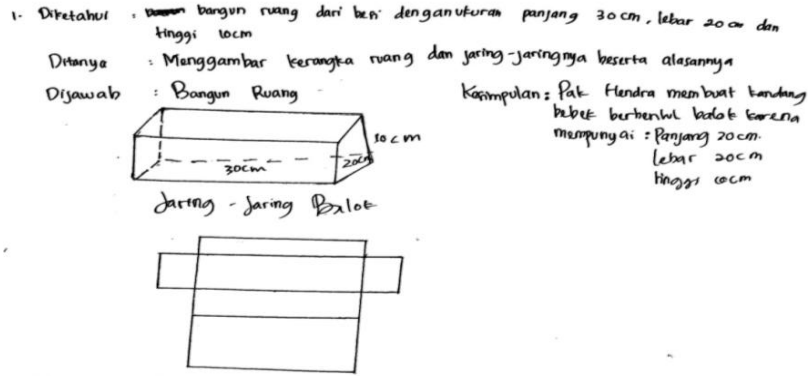

Figure 5. Results of the work of subject 1 cognitive style verbalizer question number 1

Based on Figure 5. at the looking stage the subject was able to solve question number 1 by writing what was known in the question. In the seeing stage, the subject is capable to compose down what is inquired in the question. The imagining stage is able to draw spatial shapes on the flat sides of blocks with dimensions of 30cm length, 20cm width and 10cm height and make nets from blocks but not include dimensions, meaning that the subject is not yet fully able to determine the pattern with the activity of describing the problem and writing down the solution to solving the problem in a problem. . In the showing and telling stage, the subject writes the conclusion of the solution to the problem that has been worked on. This is not in accordance with the instructions on the question, but he is able to provide an explanation in his own language regarding the reasons for the picture he created.

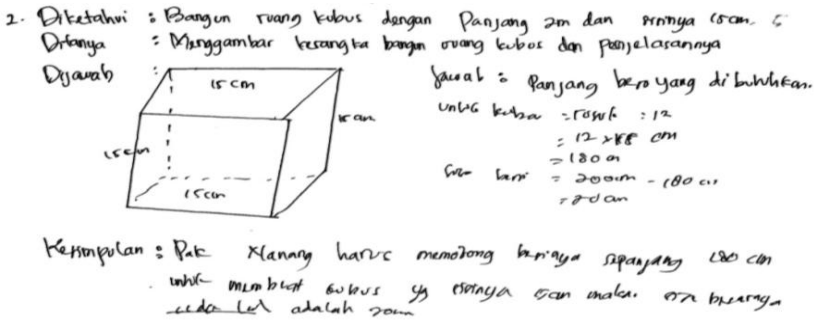

Figure 6. Results of the work of subject 1 cognitive style verbalizer question number 2

Based on Figure 6. at the looking stage the subject is capable. The stage of seeing the subject is capable. The imagining stage is able to draw the flat side of a cube with a rib length of 15 cm and look for remaining iron by finding a result of 20 cm. The showing and telling stage was able to write the conclusion of the solution made, but when asked about the steps in the solution made, he answered confusedly. This proves that the subject has not been able to explain what was obtained from the problem and present the results.

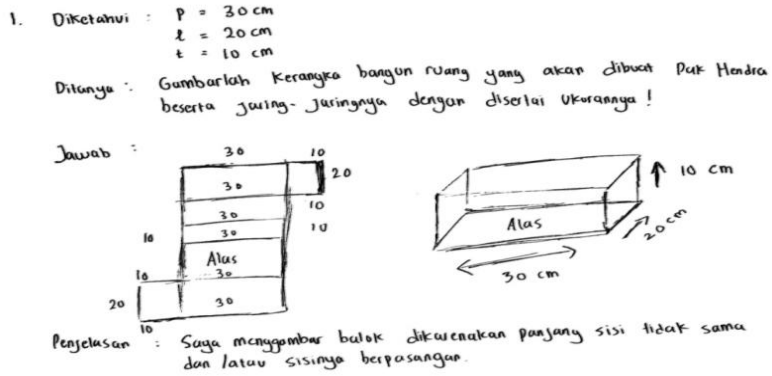

Figure 7. Results of the work of subject 2 cognitive style verbalizer question number 1

Based on Figure 7. at the looking stage the subject is capable to write down what is known in the question. In the seeing stage, the subject is capable to write down what is asked in the question. The imagining stage was able to draw a flat-sided spatial shape of the block with dimensions of 30cm long, 20cm wide and 10cm high, but when making a net from the blocks it was not quite right because the number of sides was excessive. This means that the subject has not been able to reach this stage. The showing and telling stage is able to write conclusions from solving the problems that have been worked on.

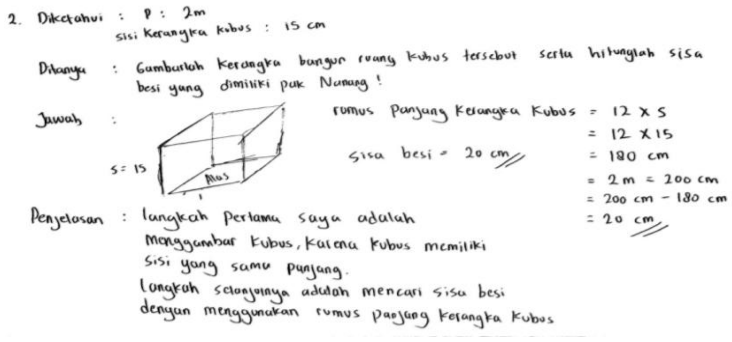

Figure 8. Results of the work of subject 2 cognitive style verbalizer question number 2

Based on Figure 8. at the looking stage the subject is capable to write down what is known in the question. In the seeing stage, the subject is capable to the subject is capable to compose down what is inquired in the question.in the question. The imagining stage was able to draw the shape of the flat side of the cube accompanied by a rib length of 15 cm and look for remaining iron and found a result of 20 cm. The showing and telling stage is able to write down the completion steps taken.

Discussion

Based on several research activities that have been carried out, quantitative findings in this research were obtained, namely that there was an influence of the use of the CTL learning model on students' visual thinking abilities in the experimental class (VIII-D) and control class (VIII-C) which used the learning model. conventional lectures. This finding is in line with inquire about with comes about appearing the impact of the CTL learning demonstrate on numerical issue tackling capacities within the eksperimental course and control course (Muslihah & Suryaningrat, 2021). There are contrasts in scientific issue understanding capacities between understudies who utilize the CTL demonstrate and understudies who utilize customary learning (Mamartohiroh et al., 2020). Arithmetic learning that employments the relevant instructing and learning (CTL) learning show moreover encompasses a positive impact on understudy learning results in 3d shape fabric (Sari et al., 2018). The utilize of contextual educating and learning (CTL) learning strategies features a positive impact on student mathematics learning results (Salam et al., 2023). The relevant educating and learning (CTL) learning demonstrate incorporates a critical impact on students' understanding of mathematical concepts by 66.5% (Aruan et al., 2022).

Based on the comes about of qualitative research that has been carried out, it was found that students who have a visualizer cognitive style are able to achieve looking indicators by identifying problems with viewing and reading activities and collecting information on a problem. This can be in line with investigate which states that visualizer students pay close attention to the questions given by reading the questions repeatedly so that they are able to compose down what they know in the questions correctly (Vianjaya et al., 2022). Visualizer students are able to recognize issues by stating all the information known in the problem (Hidayat & Ismail, 2022). Many looking indicators can be achieved in the ability to think visually in solving PISA questions, where the PISA questions include geometry in the solution (Sundari & Prabawati, 2019). Students with a visualizer cognitive style are able to achieve indicators of the ability to think visually seeing by understanding and comprehending the connection among what

is known and what is asked with the activity of selecting and grouping and planning problem solving in a problem. This can be in line with the results of visualizer students being able to convey ideas or plans that will be carried out to illuminate the questions given (Mulyo et al., 2019). Students who are able to achieve the seeing indicator are finally able to write down the solution steps that will be used and reveal the process carried out in solving the problem (Yogi et al., 2021). Students with a visualizer cognitive style are able to achieve indicators of visual imagining thinking ability by determining patterns with the activity of describing problems and writing problem solving solutions to a problem. This can be in line with the results that visualizer students are able to solve mathematical problems by looking for relationships between the mathematical concepts being studied (Habibi et al., 2020). Students with a visualizer cognitive style are capable to provide logical reasons for choosing answers as solutions to problems based on real conditions or images (Novitasari et al., 2021). Students with a visualizer cognitive style are able to achieve indicators of the ability to think visually, showing and telling, by being able to explain what was obtained from the problem and presenting the results. This can be in line which states that visualizer students can explain how they solve problems in a coherent and clear manner (Habibi et al., 2020). Visualizer students are able to carry out the steps to solve problems and make conclusions from the solving steps that have been taken (Sintiya et al., 2021).

Based on the comes about of inquire about that has been carried out, understudies who have a verbalizer cognitive style are able to achieve indicators of visual looking thinking ability by identifying problems with viewing and reading activities and collecting information on a problem. Verbalizer students are capable to get it any data that's realized by composing down the data within the shape of what is known within the question completely (Septyani, Siswono, 2018). Verbalizer students are able to understand problems by writing down what they know in the questions given (Astuti & Ismail, 2019). Students with a verbalizer cognitive style are capable to achieve indicators of the ability to think visually seeing by understanding and comprehending the connection among what is known and what is inquired with the activity of selecting and grouping and planning problem solving in a problem. This is in line with research results that verbalizer students can express the information questioned in the questions correctly (Hasan, 2020). Verbalizer students are able to select and understand problems by explaining what is being asked completely (Vianjaya, Zuhri, Setyawati, 2022). Students with a verbalizer cognitive style have not yet reached the indicators of the ability to think visually imagining because they have not been able to determine patterns with the activity of describing problems and writing down solutions to solving problems in a problem. Ververbalizer students have difficulty solving

problems using pictures (Ugi et al., 2022). Students with a verbalizer cognitive style are able to achieve indicators of visual thinking ability showing and telling by explaining what was obtained from the problem and presenting the results. Verbalizer are able to show the comes about of the work carried out by writing the final results and conclusions on each question (Miftahurrohmah et al., 2020).

Conclusion

Based on the results of the data presentation that implemented described, it is concluded that there's an impact of the CTL learning model on the visual thinking abilities of class VIII students at MTs Negeri 4 Tulungagung. The visual thinking ability of students with the visualizer cognitive style in problems solving in class VIII MTs Negeri 4 Tulungagung flat-sided building material is able to achieve all indicators of visual thinking ability, namely looking, seeing, imagining, showing & telling. Students' visual thinking ability with a verbalizer cognitive style in solving problems on flat-sided spatial construction material for class VIII MTs Negeri 4 Tulungagung was able to achieve 3 indicators of visual thinking ability, namely looking, seeing, showing & telling.

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